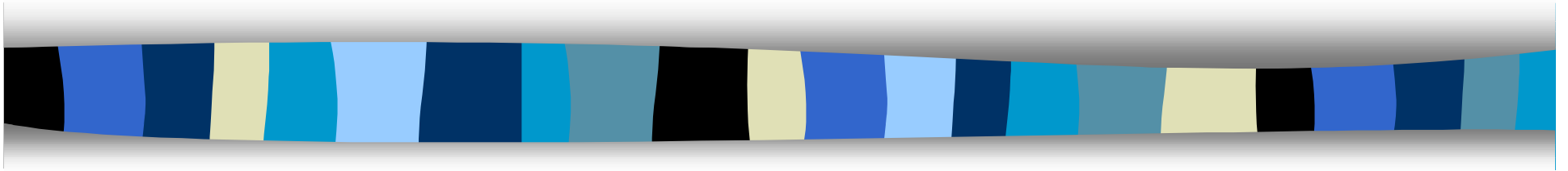


# Phase 3 RFG: Preliminary Economic Impact Analysis and Related Issues



**Gordon Schremp**  
**California Energy Commission**  
**November 22, 1999**



# Introduction

- Background
- Refinery Modeling Assumptions
- Preliminary Modeling Results
- Differences Compared To 1998 MTBE Study
- Factors Affecting Modeling Results
- Related Issues
- Closing Remarks



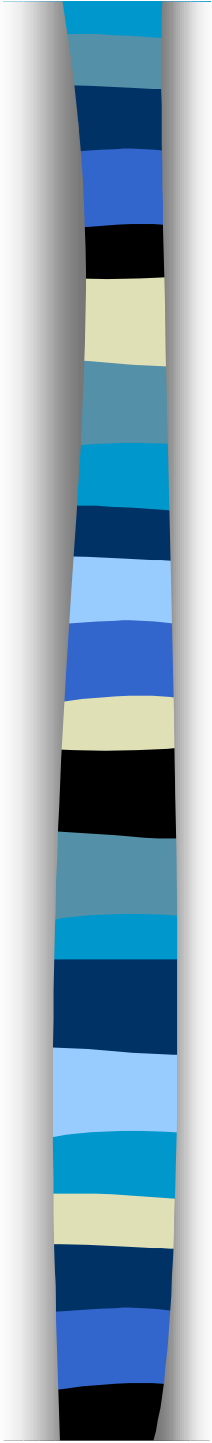
# Background

- 1998 MTBE Study
- Executive Order D-5-99
- Phase 3 RFG Proposed Specifications
- Economic Analysis By CEC



# Refinery Modeling Assumptions

- 1998 Properties
- Compliance Margins
- Emission Deltas
- Refinery Capacity
- Imports
- Exports
- Other Gasolines
- Cost Impacts



# Assumptions - 1998 Properties

- CEC Survey - October 1999
- Average In-Use Fuel Properties
  - Rvp 6.78 psi
  - Sulfur 21.8 ppm
  - Benzene 0.59 vol. %
  - Aromatics 23.42 vol. %
  - Olefins 4.5 vol. %
  - T50 200.8° F
  - T90 309.7° F



# Assumptions - Compliance Margins

## ■ Flat Versus Average

## ■ Difference Between Recipe And In-Use

—Rvp	0.22 psi
—Sulfur	4 ppm
—Benzene	0.18 vol. %
—Aromatics	1.9 vol. %
—Olefins	2.3 vol. %
—T50	4° F
—T90	7° F



# Assumptions - Emission Deltas

- Predictive Model
- Candidate Versus Reference Fuels
- Deltas For  $\text{NO}_x$ , THC, And Toxics
- Deltas Not Zero For Each Pollutant
- Refinery Modeling Deltas
  - $\text{NO}_x$  target of -0.2
  - THC target of -0.1
  - Toxics target of -0.2



# Assumptions - Refinery Capacity

- Capacity Creep By 2003
- Low Sulfur Levels For Specific Components
  - Alkylate at 2 ppm
  - Hydrocrackate & reformat at 1 ppm
- Additional Capacity Build For Each Case Possible Refinery Modeling Outcome
- Additional Imports Possible Refinery Modeling Outcome





# Assumptions - Imports

- Model Can Import Ethanol & Various Gasoline Blending Components
- Supply Cost Curves
- Values Compared To 1998 Study
  - CARBOB increased by 2 cents per gallon
  - Alkylate increased by 7 cents per gallon
  - Ethanol increased by 27 to 48 cents per gallon
- Alkylate Quality C7, Not Mixed
- Alkylate Limited To 111 TBPD



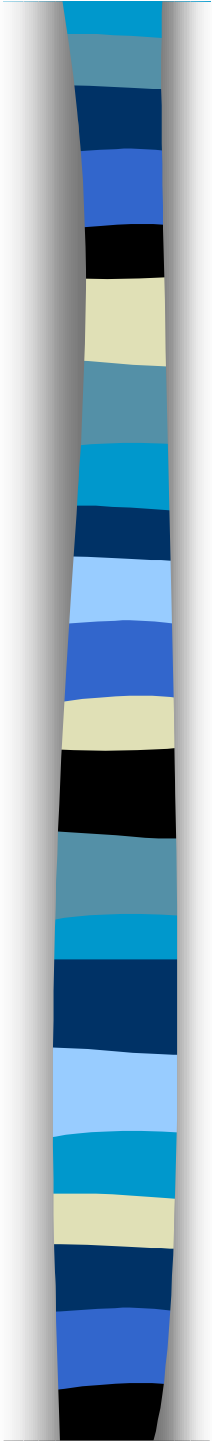
# Assumptions - Exports

- Some Components Not Suitable For Use Under Various Cases
  - Pentanes
  - Light FCC Gasoline
- Products Exported To Markets Outside State At Low Values



# Assumptions - Other Gasolines

- California Refineries Also Produce Gasoline For Arizona And Nevada
- 2003 AZ Gasoline Will Use Ethanol
- 2003 Nevada Gasoline Will Not Contain Any Oxygenates
- Gasoline Qualities Assumed Not To Become Poorer Through Dumping



# Assumptions - Cost Impacts

- Change In Production Cost Compared To Base Case
- Average Cost Impact Calculation
  - Variable Costs
  - Refinery Capital Charges
  - Ancillary Refining Costs
  - Logistics Costs
  - Mileage Change Impact



# Preliminary Modeling Results

- Base Cases

- Predictive model change

- Ethanol At 2.0 Wt. Percent

- MTBE phaseout impact

- Phase 3 RFG specifications impact

- Less stringent distillation temperature impact

- Less stringent volatility impact



# Results - Base Case

- MTBE In Use
- Phase 3 Predictive Model
- Average Cost Declines 0.2 Cents Per Gallon



## Results - Case 1A, No MTBE

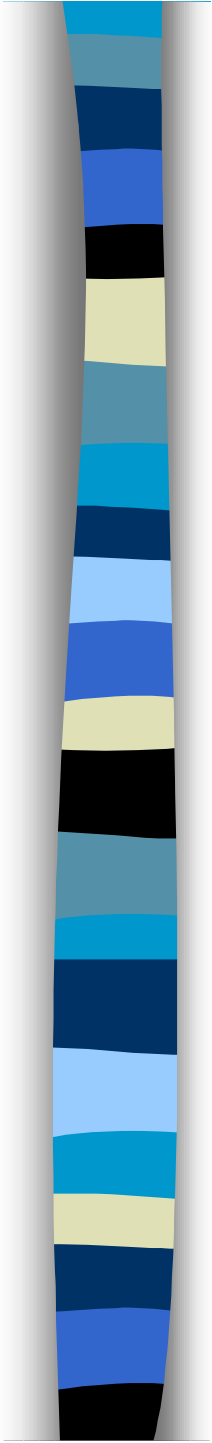
- No MTBE, Ethanol At 2.0 Wt. %
- Phase 3 Predictive Model
- Average Cost Increases 5.5 Cents Per Gallon
- Refinery Investment \$348 Million
- 111 TBPD Imported Alkylate
- 47 TBPD Rejected Blendstocks
- Expensive Imports Primary Factor



# Results - Case 2A, ARB Proposal

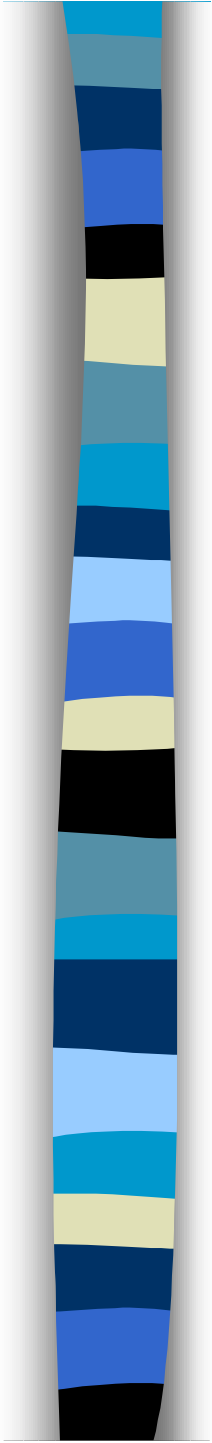
- No MTBE, Ethanol At 2.0 Wt. %
- Phase 3 Predictive Model
- Average Cost Increases 6.4 Cents Per Gallon
- Refinery Investment \$564 Million
- 111 TBPD Imported Alkylate
- 49 TBPD Rejected Blendstocks
- Expensive Imports Primary Factor
- Additional Refinery Modifications





## Results - Case 3A, Higher Distillation Temperatures

- No MTBE, Ethanol At 2.0 Wt. %
- Phase 3 Predictive Model
- Average Cost Increases 5.2 Cents Per Gallon
- Refinery Investment \$411 Million
- 111 TBPD Imported Alkylate
- 39 TBPD Rejected Blendstocks
- Expensive Imports Primary Factor



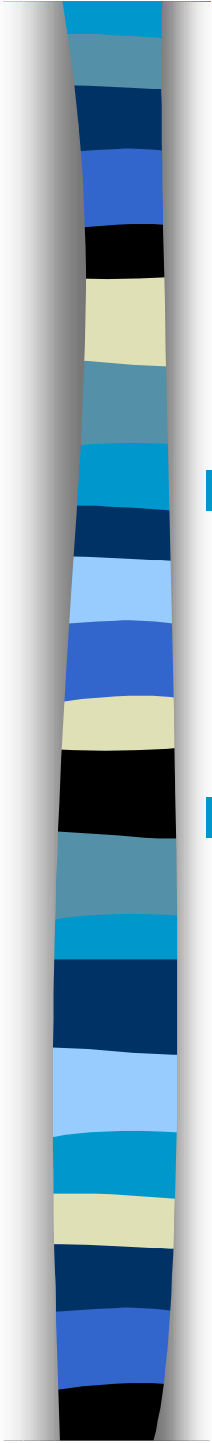
## Results - Case 4A, Higher Volatility (Rvp)

- No MTBE, Ethanol At 2.0 Wt. %
- Phase 3 Predictive Model
- Average Cost Increases 5.7 Cents Per Gallon
- Refinery Investment \$442 Million
- 111 TBPD Imported Alkylate
- 49 TBPD Rejected Blendstocks
- Expensive Imports Primary Factor



# Results - Comparing Current Cases

- Using Phase 3 Predictive Model  
Decreases Average Costs 0.2 Cents
- Phasing Out MTBE Increases Average  
Costs 5.7 Cents Per Gallon
- Phase 3 RFG Specifications Increase  
Average Costs 0.9 Cents Per Gallon



## Results - Comparing Current Cases (cont.)

- Higher Distillation Temperatures Decrease Average Costs 1.2 Cents Per Gallon
- Increasing Rvp 0.1 PSI Decreases Average Costs 0.7 Cents, Compared To Current ARB Proposal



# Differences Compared To 1998 MTBE Study

- Similar 1998 Ethanol Case Resulted In Average Cost of 1.9 cents Per Gallon Versus 6.4 Cents Today
- Primary Reasons:
  - Higher cost of ethanol
  - Higher cost of alkylate
  - Different fuel specifications



# Factors Affecting Modeling Results

- Could Average Cost Impacts Decrease?
- Could Average Cost Impacts Increase?



# Factors Which Could Decrease Average Cost

- Less Expensive Ethanol
  - Over build of ethanol supply
  - Elimination of federal oxygen requirement
  - Elimination of import tariff
- Less Expensive Alkylate
  - Over build of alkylate supply
  - Production of iso-octane from converted MTBE facilities



## Factors Which Could Decrease Average Cost (cont.)

- Decreased Marine Shipping Costs
  - Elimination of Jones Act
- Ability To Ship Ethanol Blends Through Pipeline Distribution Infrastructure
- Increase In Availability Of Desirable Blending Components
  - Lower sulfur standards in rest of U.S.





# Factors Which Could Increase Average Cost

- More Expensive Ethanol
  - Under build of ethanol supply
  - MTBE ban outside California
  - Elimination of federal excise tax credit
- More Expensive Alkylate
  - Under build of alkylate supply
  - Greater demand for alkylate
  - MTBE ban outside California



## Factors Which Could Increase Average Cost (cont.)

- Decrease In Ability Of Importers To Continue Supplying California
  - No investments to meet new fuel specifications
- Decrease In Availability Of Desirable Blending Components
  - Cleaner components being used to meet stricter fuel standards in U.S. and Europe
  - No alkylate available, refiners build sufficient capacity



## Related Issues

- Lower Sulfur Modeling Runs
- Refinery Capacity
- Price Volatility



## Related Issues - Lower Sulfur Standards

- Modeling Runs For Sulfur Limit Of 2 PPM and Cap Of 5 PPM Not Run
  - Expense of lowering average to 5 PPM in PADDs 1 - 3 Estimated At 2 to 3 Cents
  - Achieving the SC5 standard appears technically feasible, but only with advanced new desulfurization technologies and significant changes in refinery operation.
  - Technology to produce gasoline at average of 2 not currently available



## Related Issues - Lower Sulfur Standards

- Additional Expense Of Lowering Average Sulfur Content To 2 PPM Is Expected To Be Much Greater Than 3 Cents Per Gallon
  - Additional cost of phase 3 RFG proposal only 0.9 cents per gallon
- Cap Of 5 PPM Could Limit Ability Of Refiners To Consistently Produce Complying Gasoline



## Related Issues - Refinery Capacity

- Aggregate Refinery Modeling Results May Not Be Indicative Of Individual Company Investment Decisions
  - Refinery production capacity could decline if refiners choose not to make up for all of the lost volume
  - CEC initial estimate of 5 to 10 percent decline
  - ARB initial estimate of 10 to 20 percent decline



## Related Issues - Price Volatility

- Phase Out Of MTBE And More Stringent Fuel Specifications Could Result In Greater Price Volatility For California
- Today's Minor Unplanned Outages Will Have Greater Impact In The Future
  - Future outages will degrade ability to make same volume of complying gasoline



# Closing Remarks

- Additional Modeling Runs Prior To December 9 Board Hearing
  - Ethanol at different volumes
  - No oxygenates
  - Combination of ethanol and no oxygenates